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A SHORT ACCOUNT OF THE MANNER Propoſed for REBUILDING of *Briſtol-Bridge*:

AND

Some OBSERVATIONS on the OLD PIERS:

WITH

An ESTIMATE for PERFORMING the WORK.

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BRITISH MUSEUM

A
DESCRIPTION
OF THE
DESIGNS
Adapted for Rebuilding of
BRISTOL STONE-BRIDGE.

THIS deſign conſiſts of three circular arches, two piers, and two abutment piers, of the following dimenſions, viz.

But. Pier,	Arch,	Pier,	Arch,	Pier,	Arch,	But. Pier,
5½ f.	48	12	54	12	48	5½ f.

The area of the ſection of the river at the old bridge being 26 f. in the land-breaſt, and nearly 185 wide - -	4810
Area of the ſection a little above the old bridge, the land-breaſt as before, and 160 f. wide. -	4160

Area of the piers or ſolids in the old bridge	2940	4810
Area of the arches or voids in ditto	1870	
Section of the Piers or ſolids in the old bridge	86 1	185
Section of the arches or voids in ditto	98 11	
Area of the piers or ſolids in the new deſign	2356	4810
Area of the arches or voids in ditto	2454	
Section of the piers or ſolids in the new deſign	35	185
Section of the arches or voids in ditto	150	

Area of ſolids to voids in old bridge -	as 3 to 2	nearly
Section of ſolids to voids in ditto -	as 8 to 9	
Area of ſolids to voids in new deſign -	as 1 to 1, 04	
Section of ſolids to voids in ditto -	as 1 to 4, 28	

The new bridge, from out to out, 48 feet, carriage-way 31 f. two foot-ways 7 f. each, and roſe 1 foot above the carriage-way. The balluſtrade 4 f. high.

In the following deſcription, I conſider the bridge to be entirely new, from the foundation.

THE piers to be laid upon a firm ground, a ſufficient depth under the bed of the river: as the foundation conſiſts of hard ſand or gravelly body, the work won't be difficult or expenſive.

The piers to be built upon a ſtrong grating of timber, to extend near 5 feet without the lower courſe of ſtone-work.

The piers to be built ſolid, with large ſtone of one, two, or more tons in a block. The two lower courſes 2 feet high, each with a ſection or retreat of 1 foot all round, like two plinths one upon the other. The piers to be carried up 2 feet above low-water mark, or thereabouts.

The becs or points of the piers to be right-angles.

In order to give the utmoſt ſtrength to the arches of the bridge, there is a ſecond arch, built and bounded in with the under arch, but with thinner ſtone. The upper arch is of a particular curve, being thicker in the reins than at the top, in order to preſerve an equilibro

libro of the arch-ſtones in all its parts, and thereby counter-act or deſtroy the thruſt or lateral preſſure of the arches againſt the piers and butments.

The finiſhing the front of the bridge.

THE coins or architrave of the arches, thro' the ſuffete and the front of the turrets, &c. to have chamfered joints, becauſe experience proves ſuch ruſtick decoration of the archivolt of the arches to have a very good effect in large works, and it alſo prevents the fluſhing or breaking the edges of the ſtones in the joints.

The front of the ſpandrels of the arches to be filled with hewn ſtone, with proper bond and the joints, to preſerve a tendency to the center, which is much preferable to the common way of laying the ſtone in horizontal courſes.

The reaſon why it is ſo convenient, ariſes from the great ſtrength it will acquire to bear the additional weight, which no other part of the arches can ſuſtain: I mean, the weight of the cornice, plinths, and the balluſtrade, &c.

The becs or points of the piers are deſigned to be carried up in form of octagonal turrets, in order to have the points and middle of the piers as equally loaded as poſſible, which will contribute to the ſecurity of the whole ſuperſtructure: Theſe ruſticated turrets will form uſeful and commodious receſſes for foot-paſſengers, where they may retreat, if any buſineſs or accident requires their ſtopping, without embarraſſing the footways, as it happens but too often in the ſtreets; as well as a neceſſary receſs in rainy weather, if they are covered in by ſemi-octagonal dooms, which will be convenient to ſupport the lamps for enlightening the bridge.

The whole is finiſhed by a ſubſtantial ſtone balluſtrade: and ſtone for this purpoſe is preferable to any ſort of iron fencing, not only as it will be leſs ſubject to decay, but it alſo preſerves a ſymmetry to the reſt of the building, which in large works ought principally to be conſidered.

Of the materials to be uſed in this deſign.

THE grating under the foundation to be either elm or fir timber. The piers to low-water mark, and the fencing to the footways, to be built with ſtone, called Mill-ſtone

Grit:

Grit: this ſort of ſtone riſes in very large blocks, from one to three tons or more, and is not ſubject to any damages by weather, neither is it affected by ſalt water; and is to be prefered on account of cheapneſs, even to Portland-ſtone, for the purpoſes aforeſaid.

The arches, cornice, turrets, plinths, hand-rail, and octagonal dooms, to be conſtructed with Foreſt-ſtone, ariſing in or adjacent to the Foreſt of Dean, &c.

The front of the ſpandrels to be built with Felton-ſtone, which being of a darker colour, will be as a back ground to the front of the arches.

The ſecondary arch, to be built with a flat ſtone, to be had in the foreſt of Dean, very fit for that purpoſe.

The paving in the foot-ways Felton-ſtone, uſed edgeway, which will be very durable.

The backing to the front walls, Croſs-Wall on the piers; the dry-walls and looſe-ſtone, to make level the ſpandrels of the arches for the carriage-way, &c. to be all ſupplied from the old materials in the preſent bridge.

The balliſters Free-ſtone, becauſe of its being eaſily turn'd or worked, if either Painſ-

wick

wick or Bath ſtone. The ſort of lime deſigned for the mortar in the whole ſuperſtructure, from the foundation to the cordon or cornice will make mortar as good as any Dutch tarris, and will ſet in water equal with any cement whatſoever.

The carriage way to be finiſhed with good pitching or paving, of large ſtones ſet in ſtrong ſand.

N. B. The ſeveral ſorts of materials beforementioned lie contiguous and convenient for water-carriage, which enables me to make out my eſtimate the more reaſonable.

Remarks and obſervations in regard to conſtructing three new arches, on the old foundations of the preſent piers; pointing out the hazard and difficulties that muſt attend ſuch an attempt.

FIRST,

IN the preſent caſe we are to conſider what materials the old piers are built with, and the condition of them. It appears they are only caſed with a larger ſort of ſtone, of ordinary workmanſhip, and the inſide body of the piers probably are filled up with rough ſtone, promiſcuouſly laid in mortar, which by length of time has acquired a hardneſs of cement, ſufficient to ſupport the preſent narrow arches.

That the old piers are only caſed work, appears from many old decayed bridges; particularly in the old pier taken down in the alterations of London bridge, which I had the curioſity to examine upon the ſpot; and that was built in the manner above-mentioned. There are other inſtances of ſuch methods being uſed in building the piers of old bridges: By examining the old piers at Briſtol, I find the appearance of ſetts and chaſms, whether of recent date or not, I cannot ſay; but, their decayed appearance to me, cannot engage any conſideration of their future ſervice, to ſupport a new ſuperſtructure.

SECONDLY, The conſequence of opening the old piers may be very ruinous to them, as, probably the inſide of the piers are not at preſent affected by the circumambient water, though immerſed twice in every twenty-four hours: But, when they are opened, and the water paſs freely over them, it may occaſion the inſide mortar to diſſolve and decay, which of courſe muſt affect the old foundations, and make it too precarious to venture a new building thereon with any probability of ſucceſs; but, ſuppoſing the caſe in a more favourable light, there is another difficulty ariſes of more conſequence than any before-mentioned, and that is the want of ſufficient baſis or ground-plan, to contain the foundation of the propoſed new arches. The plan of the old piers, 'tis true, are ſufficient in breadth to admit of new

new arches; but then, they want an addition to the length. Now, to attempt to add new maſon-work to the old piers, will be a taſk not ſo eaſily executed as may be ſuppoſed; becauſe, experience teaches us the difficulty there is even of joining a new walling to a rockey and irregular foundation, in building the walls of a fortreſs though upon dry land, without having ſetts and chaſms; but, it will be found to be much more difficult and precarious to be attempted under water, as it muſt be in the preſent caſe. There is but one favourable ſuppoſition that may facilitate ſuch difficulty, and that is, ſhould the preſent piers be ſound to be built upon piles (for it don't appear at preſent in what manner they are founded.) In this caſe, a continuation of the piling may anſwer the end, if cut off under the bed of the river; but, this is only conjecture: I think there is no dependance to be put on it. I am therefore of opinion, the only ſure method will be entirely to deſtroy the preſent piers, and to ſeat down new piers upon a timber grating, at a proper depth under the bed of the river, by means of a caiſſon, in that excellent practical manner that was lately made uſe of in the building of Weſtminſter-Bridge: The expence of this method will be the leaſt of any other, and executed with more certainty of ſucceſs. On the other hand, upon excavating the foundation, ſhould the ground be found to be not ſufficiently compact to receive the grating and bear the great weight it is to ſupport; in that caſe we muſt have recourſe to piling, or other methods for ſecuring the bottom of the excavation ſufficient to bear the incumbent weight of piling which is applied for this purpoſe: the piles are to be cut level at the bottom of the foundation pit, by which means there will be no occaſion of ſtirlings to prevent the gullying and wearing away of the ſand or gravel under the foundation, as may be the caſe, if the piles were only cut off level with the ſurface of the bed of the river. Inſtances of that bad practice are too frequent, notwithſtanding, I ſuggeſt the method of piling, to ſecure a bad foundation, I am very well convinced, there will be no occaſion of any ſuch extraordinary expence in ſeating the piers of the new bridge; for we ſee the land-breaſt or wharf-wall along the Back, quite up to the Bridge, ſtand firm, without any ſets or cracks; though this wall is very high, being upwards of 26 feet from the bed of the river; and, as I have been informed, is only founded upon a hard bed of ſand, which in all caſes is a very good foundation.

It is propoſed to conſtruct the centers for turning the arches in ſuch manner, that the navigation of the Up-River ſhall not be interrupted by any works uſed in rebuilding the intended bridge.

It

It is to be obſerved, that, in caſe the piers as well as the arches are entirely rebuilt, in that reſpect care muſt be taken, not to fix the temporary bridge ſo near the old one, as to cauſe any interruption to the new works; conſequently the old butment-pier cannot be a ſupport to ſuch intended temporary-bridge, as has been ſuppoſed: and therefore care muſt be taken to fix a proper place, that the eſtimate for executing of it may be made accordingly: for in works where large excavations are made in the bed of the river, and heavy ſtones are uſed in the building, a great deal of room is wanting; and workmen can't admit of being confined, without great injury and extra-expence to the undertaker.

MEMORANDUM.

In caſe of making uſe of the old piers, for the ſupport of the new arches, the following diſtribution of the arches and upper part of the piers may be convenient.

THIS deſign will conſiſt of one elliptical arch, two piers, and two ſemicircular arches, and two old abutments, of theſe dimenſions, viz.

	Circular Arch.	Pier.	Elliptical Arch.	Pier.	Circular Arch.	
Old butm.	36	15	84	15	36	Old butm.

Section of the piers or ſolids in ſuch elliptical deſign	30	185
Section of the arches or voids	155	

Section of ſolids to voids as 1 to 5, 16.

If this deſign was to be executed, I ſhould propoſe to execute the work in the ſame manner as the former deſign, from the foundation of the old piers, and with the ſame materials and outward ornament, and to entirely remove the center old pier.

An

BRITISH MUSEUM

AN

ESTIMATE
OF THE
EXPENCE
For Constructing and Rebuilding
Bristol Stone-Bridge,
According to the Plans and Method deſcribed
in the preceding PAPER,

By FERDINANDO STRATFORD, Engineer.

IN the conſtructing ſuch ſtone bridge, there will be required the following materials and workmanſhip:

	l.	s.
Timber in the gratings, caiſſon, centers, guard-piles, booms, and ſcaffolding, 531 tons — —	3346	10
Deals in the gratings and caiſſon, 7 hundred	106	1
Mill-ſtone Gritt in the piers and foot-way borders, 2705 tons — —	3293	6
Foreſt ſtone in the arches, turrets, cornice, plinths, rails, and dooms, 2879 tons	3488	17
Felton and thin Foreſt-ſtone in the front, ſpandrels, footway, paving, and ſecondary arches, 2375 tons —	3456	5
Bath or Painſwick ſtone balluſters, 240 cub. f.	60	00
Excavation, or digging in the foundation pits, 2116 tons — —	370	6
Maſon's work in croſs-walling, 930 perches	151	14
Ditto, in dry-walling, 352 ditto	17	12
Filling ſpandrels, 720 cub. yards -	36	2
Paving or pitching carriage-way, with materials, 660 yards — —	82	10
Iron-works in cramps, with lead -	300	00
Water pumping — —	500	00
Carving ſix antique heads in the key-ſtones	31	10
Uſe of lighters and barges, &c. —	500	00
To the undertaker, at 6 *l.* per cent.	932	8
Total	16673	1

July 31, 1760.